

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of:

Attorney Docket No.: 9896.149.0

CHAPPA, et al.

Application No.: 10/028,518

Examiner: Hai Vo

Filed: December 21, 2001

Group Art Unit: 1771

For: REAGENT AND METHOD FOR PROVIDING COATINGS ON SURFACES

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**AFFIDAVIT UNDER 37 CFR 1.132**

Commissioner for Patents  
PO Box 1450  
Alexandria, VA 22313-1450

State of Minnesota                    )  
  )       S.S.  
County of Hennepin                 )

Mr. Dale G. Swan, being first duly sworn, deposes and says:

1. I am Dale G. Swan. I am an inventor on the above-referenced patent application and I am the first-named inventor on United States Patent No. 5,414,075 (the '075 patent), which has been cited by the Examiner to reject the pending claims of the above-referenced patent application.

2. I am currently employed at SurModics, where I have worked for eighteen years. During my employment at SurModics, I have worked for about sixteen years on development, testing, and commercialization of polymeric coatings. I have also worked for about twelve years on development, testing, and commercialization of reagents usable in grafting polymers to surfaces and methods of using such reagents to cause polymerization of monomers to a surface through activation of these agents. I received a M.S. degree in Organic Chemistry from University of Minnesota in 1972. I received a B.A. degree in Chemistry from the Bethel College in 1963.

3. This affidavit is being submitted to explain the relevant differences between the subject matter claimed in this application and the cited art, and to present and explain data to show that coatings prepared by grafting as claimed in this application are structurally different than the immobilized coatings described in the '075 patent.
4. An experiment was run to demonstrate that the polymeric coatings obtained by grafting as claimed in the present application are structurally different than the coatings obtained by immobilization as described in the '075 patent. In summary, six glass slides were coated. Three of the samples (Samples 1-3) included graft coatings in accordance with embodiments of the presently claimed invention. That is, a grafting reagent having at least one photoinitiator and a polymerizable monomer solution were applied to the surface and the monomers were polymerized by activation of the grafting reagent to form a polymeric coating on the surface as described in the present application. The other three samples (Samples 4-6) included immobilized coatings, where a reagent and a preformed polymer were applied to the surface and the reagent was activated to bond the preformed polymer to the surface in accordance with the methods described in the '075 patent. Specifically, the experimental protocol was as follows:

**Sample 1**

Silane-treated glass slides (7.5 cm x 2.5 cm) were first dip coated with a 1 mg/ml solution of tetrakis(4-benzoylbenzyl ether) of pentaerythritol in isopropyl alcohol (IPA). After the coating had air-dried 10 minutes, the slides were illuminated for 3 minutes in front of a Dymax UV flood lamp positioned about 25 cm from the slide. Slides were then placed in aqueous solutions of 7/3% Acrylamide/2-acrylamido-2-methyl-1-propane sulfonic acid (AMPS) which had been sparged with nitrogen for 30 minutes to remove oxygen. While sparging continued, the slides were exposed to 150 sec of light from 3 UV spotlights (EFOS Ultracure 100ss Plus) positioned about 3 cm from the slides. After illumination, the coated slides were rinsed in water for 1 minute, followed by a 10 min soak in water with agitation, followed by a 1 minute rinse in water.

**Sample 2**

Silane-treated glass slides (7.5 cm x 2.5 cm) were first coated with a 1 mg/ml solution of ethylenebis(4-benzoylbenzyltrimethylammonium) dibromide in water. The slides were immersed in the ethylenebis(4-benzoylbenzyltrimethylammonium) dibromide solution and illuminated for 3 minutes with a Dymax UV flood lamp positioned about 25 cm from

the slide. The slides were then rinsed in water for 1 minute to remove any unbound ethylenebis(4-benzoylbenzyltrimethylammonium) dibromide. Slides were then placed in aqueous solutions of 7/3% Acrylamide/AMPS which had been sparged with nitrogen for 30 minutes to remove oxygen. While sparging continued, the slides were exposed to 150 sec of light from 3 UV spotlights (EFOS Ultracure 100ss Plus) positioned about 3 cm from the slides. After illumination, the coated slides were rinsed in water for 1 minute, followed by a 10 minute soak in water with agitation, followed by a 1 minute rinse in water.

### **Sample 3**

Same as sample 2 but with 4,5-bis(4-benzoylphenylmethylenoxy) benzene-1,3-disulfonic acid disodium salt instead of ethylenebis(4-benzoylbenzyltrimethylammonium) dibromide.

### **Sample 4**

Silane-treated glass slides (7.5 cm x 2.5 cm) were first dip coated with a 1 mg/ml solution of tetrakis(4-benzoylbenzyl ether) of pentaerythritol in IPA. After the coating had air-dried 10 minutes, the slides were illuminated for 3 minutes in front of a Dymax UV flood lamp positioned about 25 cm from the slide. The slides were then dipped in a 25 mg/ml polyvinylpyrrolidone-Kollidon 90 (PVP-K90) solution in 50/50 IPA/water and withdrawn at a rate of 0.25 cm/sec. After the coating had air-dried 10 minutes, the slides were again illuminated for 3 minutes.

### **Sample 5**

Silane-treated glass slides (7.5 cm x 2.5 cm) were first coated with a 1 mg/ml solution of ethylenebis(4-benzoylbenzyltrimethylammonium) dibromide in water. The slides were immersed in the ethylenebis(4-benzoylbenzyltrimethylammonium) dibromide solution and illuminated for 3 minutes with a Dymax UV flood lamp positioned about 25 cm from the slide. The slides were then rinsed in water for 1 minute to remove any unbound ethylenebis(4-benzoylbenzyltrimethylammonium) dibromide. Then, the slides were dipped in a 25 mg/ml PVP-K 90 solution in 50/50 IPA/water and withdrawn at a rate of 0.25 cm/sec. After the coating had air-dried 10 minutes, the slides were again illuminated for 3 minutes.

### **Sample 6**

Same as sample 5 but with 4,5-bis(4-benzoylphenylmethylenoxy) benzene-1,3-disulfonic acid disodium salt instead of ethylenebis(4-benzoylbenzyltrimethylammonium) dibromide.

5. After the coatings were applied to the glass surfaces, a brass knife was used to remove a portion of the coating from each glass surface. This step was taken to provide a measurable step height between the coating and the glass surface. An optical interferometer was used to measure

the step heights at multiple locations on each coated slide. This step height is representative of the thickness of the coating.

6. The interferometry results show that the grafted coatings are about an order of magnitude thinner than the immobilized coatings. As shown in Table 1, the average thickness of the grafted coated samples, Samples 1-3, ranged from 9.4 nanometers to 86.8 nanometers. In contrast, the average thickness of the immobilized coatings, Samples 4-6, ranged from 993.7 nanometers to 1056.1 nanometers.

**Table 1**

| Sample ID                    | Reagent  | Topcoat  | Thickness (nm) | Average Thickness (nm) |
|------------------------------|--|--|----------------|------------------------|
| Grafting Examples            |  |  |                |                        |
| 1                            | tetrakis(4-benzoylbenzyl ether) of pentaerythritol                             | Acrylamide/2-acrylamido-2-methyl-1-propane sulfonic acid | 11.0           | 9.4                    |
|                              |  |  | 4.3            |                        |
|                              |  |  | 12.9           |                        |
| 2                            | ethylenebis(4-benzoylbenzyl dimethylammonium) dibromide                        |  | 89.3           | 86.8                   |
|                              |  |  | 86.2           |                        |
|                              |  |  | 84.9           |                        |
| 3                            | 4,5-bis(4-benzoylphenylmethyleneoxy) benzene-1,3-disulfonic acid disodium salt |  | 45.8           | 50.9                   |
|                              |  |  | 52.0           |                        |
|                              |  |  | 55.0           |                        |
| Immobilized Coating Examples |  |  |                |                        |
| 4                            | tetrakis(4-benzoylbenzyl ether) of pentaerythritol                             | Polyvinylpyrrolidone-Kollidon 90                         | 932.9          | 993.7                  |
|                              |  |  | 1113.9         |                        |
|                              |  |  | 934.2          |                        |
| 5                            | ethylenebis(4-benzoylbenzyl dimethylammonium)                                  |  | 814.5          | 974.1                  |
|                              |  |  | 1202.1         |                        |

|   |  |  |        |        |
|---|--|--|--------|--------|
|   | dibromide  |  | 905.6  |        |
| 6 | 4,5-bis(4-benzoylphenylmethylenoxy)benzene-1,3-disulfonic acid disodium salt |  | 1046.8 | 1056.1 |
|   |  |  | 1293.8 |        |
|   |  |  | 827.7  |        |

7. Accordingly, the results show that coatings prepared by grafting as claimed in this application are structurally different (i.e., thinner) than the immobilized coatings described in the '075 patent. The relative thinness of the coatings is useful, for example, for preserving a desired porosity of a porous support surface after polymerization.

Dale G. Swan  
Dale G. Swan

Subscribed and sworn to before me  
this 18th day of JANUARY, 2007.

Patricia M. Best  
Notary Public

